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Research Article

Learning Physics in the Blended Learning Mode: Input for Enhanced Strategies in Learning Physics

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ABSTRACT

Physics is a core subject in the Science, Technology, Engineering, and Mathematics strand, and high school students and Physics teachers find the subject challenging because they had to deal with multiple representations at the same time. This study aims to know the experiences of STEM students in the blended learning mode, experiences in instructional support and the difficulties and the coping mechanism implied by the students in the blended learning mode. This study employed descriptive-qualitative research and the 19 participants were chosen using purposive sampling with inclusion criteria. In gathering data, data the researchers used an in-depth interview guide that was validated by three experts. Results show that there were 16 themes that emerged. The themes for the experiences of students in blended learning are Difficult, Browsing the Internet, Asking Help, Extra effort in studying, Material Preparation, and Self-preparation. While the themes on the experiences in the instructional mode by the students are: Guided and assisted, Helpful, and difficult. The themes on Participants' Difficulties in Learning Physics are Difficulty in Understanding concepts, Lack of Focus and Attention, Difficulty in Assessments, and Difficulty in Problem Solving; while the themes for coping mechanisms are Learning Styles, Regulating Negative Emotions, Seek Support and Assistance. Therefore, this study implies that students must be provided more instructional support in teaching Physics. The researchers recommend this study to the STEM students, teachers, school heads, and future researchers.

Keywords: *Coping mechanism, Difficulties, Instructional support, Learning framework, Modes of instruction, Physics, STEM*

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Introduction

Physics is a prerequisite for comprehending the complexities of current technology and for a country's technical growth. This branch of science is contributing significantly to many of the inventions that are creating modern society, as well as helping explain many of the occurrences that occur in daily life. Physics is a core subject in the Science, Technology, Engineering, and Mathematics strand, and high school students and physics teachers find the subject challenging because they had to deal with multiple representations at the same time, such as experiments, formulas and calculations, graphs, conceptual explanations, and models are required to grasp the concepts. There is a need to address students' physics difficulties and have a better knowledge of the exact reasons that are causing their problems, thus, making it one of the hardest subjects that students encountered in school (Bray & Williams, 2022).

The study conducted by Lederman & Abell (2020) shows that Physics subject is one of the subjects that has the lowest interest of the students among all sciences subjects, because physics learning includes difficulties that are due to the particular nature of physics knowledge. As suggested, Physics should be taught through inquiry, discovery, demonstration, simulation, practical work, laboratory-based activities, and other hands-on experiences by physics educators.

On the other hand, the education sector was one of the organizations that were severely impacted by a coronavirus. Approximately 1.3 billion pupils from 177 nations throughout the world had their education disrupted as a result of the temporary school closures. In response, the Commission of Higher Education (CHED) in the Philippines recommended educational institutions to use alternative modes of delivery, such as distant learning, online learning, or e-learning, in place of traditional classroom instruction if they have the means (Superio et al., 2021). This COVID-19 radically altered the educational scene; while in the Philippines, the Department of Education (DepEd) suggested that during this pandemic, traditional approaches shift into blended learning. Blended learning became the new normal in Philippine

education. Although, blended learning is not new to the Philippine Education System since many colleges and universities around the country already adopted these concepts a long time ago (Tupas and Laguda, 2020). The three components of the blended learning strategy are: (1) mixed instructional modalities, (2) combined teaching, and (3) combined face-to-face and online teaching (Sales et al., 2022).

Furthermore, students consistently perform poorly on the Science National Achievement Test (NAT), which is the most challenging subject in the nation. As a result, they struggle to comprehend fundamental ideas. The blended learning environment's educational approach calls for active participation from the students; therefore, scientific educators should adapt teaching strategies and resources as well as evaluate students' practical science abilities. A teaching strategy for science teachers should be established in order to promote meaningful and retentive learning in order to address the poor performance in science and to meet the goal of science education (Hinampas et al., 2018).

Given the background of the study, the researcher sought to make an input for enhanced strategies in learning physics in the blended learning mode. This research focuses on describing the students' experiences on learning Physics with the instructional support that was given to the STEM students and the difficulties and coping mechanism employed by the students in learning physics in the blended learning modality. The information obtained was utilized in creating an input for enhanced strategies to help students enhance their learning in physics in the blended learning mode. This study aimed to describe the learning of physics through blended learning approach of Senior High School STEM students.

Specifically, this study will seek to answer the following questions:

1. How may the experiences of STEM students on learning Physics in the blended learning modality be described?
2. How do STEM students experience the instructional support given to them?
3. What are the difficulties encountered and coping mechanisms employed by STEM students in learning Physics?

4. What learning framework can be designed to enhance the learning of Physics?

Methods

This section provides a closer look at the methods used in describing the blended learning approach in Senior High School STEM students in learning physics.

Research Design

This study utilized a qualitative research design focusing on descriptive qualitative research. This study aims to seek persons' descriptions based on their experiences and understanding, and used an in-depth interview as an instrument. The descriptive qualitative research used to describe the experiences of STEM students on learning Physics in the blended learning modality, and describe the experience of STEM students with the instructional support given to them. This design aided the researchers to identify the difficulties encountered and coping mechanisms employed by STEM students in learning physics and to design a learning framework to enhance the learning of Physics. Thematic analysis was utilized to analyze the data gathered. Figure 2 presents the research paradigm of this study.

Locale of the Study

The study conducted in Surallah, South Cotabato, particularly in Libertad National High School with STEM students taking up Physics subject. The school implements a K to 12 basic education program that offers Junior and Senior High School. This school is implementing a blended learning approach to educate students amidst the pandemic. It was established on January 01, 1969, and located at Barangay Libertad, Surallah, South Cotabato as shown in Figure 3. The average number of students in STEM Academic Strand taking up Physics subject is 60.

Respondents

To identify the participants of the study, the researchers selected the participants based on the characteristics of a population, the objective of the study, and set an inclusion criteria. The participants were enrolled in Science,

Technology Engineering, and Mathematics strand and are currently taking up Physics subject. The inclusion criteria include participant must be a student of Libertad National High School enrolled in the Science, Technology Engineering and Mathematics strand and is currently taking up Physics subject. Participants must have good grades in Physics and will be able to communicate orally. The participants must be recommended by the teacher or the principal, and participants should be willing to share their experiences in learning physics. During the conduct of this study, there were 25 students agreed and participated in the interview. Others refused to participate verbally, therefore only 19 students were interviewed.

Research Instrument

The interview guide is the primary tool that used in the study. The questions in the interview guide were researcher-made and based on the statement of the problem. The interview guide was checked by four experts to ensure that the questions are valid to establish the correct responses needed for the study. It contains five major questions. It was correctly translated into the language that the participants are most familiar with. The questions are the following:

- a) What are the modes of instructions that you have experienced in learning physics? What are your preparations in learning Physics?
- b) What are the instructional support given by your teacher in physics?
- c) What are your experiences in learning physics?
- d) What are the difficulties you have encountered in learning physics? And how did you cope with these difficulties?
- e) What are your recommendations to improve the learning of Physics?

Data Collection

The study was conducted in Libertad National High School, South Cotabato. Before the gathering of data, the researchers prepared communication letters from the school that validates our study to be conducted. The researchers had their in-depth interview guide

validated by four experts in the field of qualitative research. The Approval letter was sent to Libertad National High School. The researchers identified the participants of the study by following the inclusion criteria. Participants were given consent letter prior to the interview. Then, researchers conducted an individual interview.

During the interview, the researchers discussed the overview, purpose, and rationale of the study. The content of the informed consent was explained to the respondent for ethical and data privacy considerations. The researchers asked permission for audio-recording interview to ensure proper and accurate transcription of data. The interview was recorded using the phone and lasted 5 to 10 minutes. The collected data was transcribed verbatim by the research assistant. The identity of the participants was protected and the anonymity of the participants was reflected as "participant n" instead of exposing their respective names. Recorded audios were deleted after it was transcribed. When results were achieved, the researchers gathered the participants and reported the findings.

Data Analysis

In this study, qualitative data was analyzed using thematic analysis following the five steps prescribed by Braun and Clarke (2006), the Moustakas method. The researchers transcribed the interactions, re-read the transcripts, and listened to the recordings. Preliminary codes were identified by extracting the significant statements. The researchers then formulated meanings from the extracted statements. The themes were identified as well as clear explanations that concisely convey the essence of each theme. Finally, the researchers transformed their analysis into an interpretable piece of writing and relayed the results of the analysis in a way that convinces the reader of the merit and validity of the analysis.

Results and Discussion

This section presents the narrative discussion of the themes that emerged in this study.

Experiences in Learning Physics

Experiences in learning refers to any interaction, course, program, or other learning experience that takes place in an online blended learning mode.

Difficult

Majority of the Grade 12 STEM students of Libertad National High School finds Physics in the blended learning mode difficult. They have hard time learning physics because the concepts are hard to understand and the formulas are long. Also, because the sources they have such as the printed module and the online sources do not coincide. When conducting assessments like quizzes and exams they have difficulty in face-to-face because they cannot browse the internet.

"The concepts are difficult to understand. The formulae are also hard to memorize." (P8)

"Hard because of the hard concepts. So sometimes I feel difficulties when having activities." (P9)

"I can do the exam if it's modular but if it's face to face exam, it's difficult." (P11)

"I felt difficult. We don't have enough knowledge, and background about physics..... Also in face to face setting I find it harder since we can't browse some ideas on the internet when the teacher is in front." (P13)

"For now, I feel that it's difficult since our teacher wasn't there always when we have questions or clarification" (P19)

Searched the internet

One of the experiences of the Grade 12 STEM students in this blended learning mode is browsing of the internet in order to cope up and understand the lessons. Also, since they are utilizing online and modular learning mode, there are times that they have to learn the lesson individually; thus, seeking YouTube or Google help the.

"We seek through online." (P2)

"I search it in the internet so that I can understand more. I prefer watching YouTube." (P4)

"If it is difficult to, we just search on the internet especially tutorial from YouTube. And it's hard to memorize so I search again in Google." (P5)

"I search it on Google if I'm experiencing difficulties, and to understand the concepts better like chrome in Google chrome." (P7)

Asked help

In this blended learning mode, students are having hard time in understanding the concepts, solving problems, and answering activities regarding their Physics subject. Thus, one of their experiences to cope with these problems is to seek help from others: a classmate, teacher, or family member. The participants said that asking help them understand the lessons.

"If there will be someone who will teach, it would be easy to grasp the lesson" (P1)

"We ask help from our teachers but if there are some easy part we can do it on our own." (p2)

"As long as we were given time to study in a group way, we can do it." (P3)

Made Extra Effort in Studying

Since students are having hard time understanding the concepts of physics, one thing that the STEM students experience in learning physics in the blended learning mode is to exert extra effort. They have mentioned that they have to add extra time studying.

"Pass on our bedtime hours to put some extra hours to understand the concepts and topics." (P1)

"There are terms that I don't understand in my own way, so it takes extra effort to understand it" (P15)

Studied in Advance

The Grade 12 STEM students prepared themselves in learning physics in the blended learning because they believe that this subject is one of the hardest subject that they will encounter in their Senior High School life. Thus, self-preparation is needed. They have mentioned that they did advance study, watch YouTube videos regarding the subject and bought some materials that they will be using in learning physics. Also, they have mentioned that they find a place conducive for learning to focus in answering their modules.

"I studied in advance before the class so that I can easily understand the lesson during the discussion." (P8)

"I watched YouTube videos or tutorial about the lesson for me to be prepared. The videos of Professor Dave kag Dan Fullerton, because they have good and simple explanation." (P11)

"I will find some place that is quiet and peaceful so I can study well in advance." (P16)

Prepared Needed Materials for Lessons

Since the Libertad National High School utilizes Blended learning (face-to-face learning, online learning and modular distance learning) in all subjects, the STEM students prepared materials in order for them to cope with this mode of learning. They have mentioned that they purchased materials that they will be needing in learning physics such as: mobile phone, notebooks, pens, and load.

"Before the physics class starts I register first my phone to GoSurf50. It's good for 1 week use during online class." (P5)

"I bought cellphone to access internet that will be used during online class. (P6)

"I bought some materials like notebooks, paper and ballpen" (P16)

Experiences with Instructional Support

Instructional support includes support from teachers and materials given to students. The STEM students are guided by their teacher, the instructional support is given to them was helpful and they felt difficulties at the same time.

Guided and Assisted by Online and Printed Resources

The Grade 12 STEM students are guided by their teacher in Physics. The instructional support given by their teacher was online such as providing the students with links to educational videos from YouTube, checking up with students through chat whenever students are absent in their online class or whenever we haven't yet passed our learning modules, and asking how's the process of answering of the learning modules.

"The teacher just providing us links" (P9)

"They send video through Edmodo." (P11)

"Our teacher reached us out through chat if we are absent during online class" (P11)

"One time, one of my classmate was not submitting his module, hence our teacher was reaching him out through chat." (P6)

"Sometimes, our teacher is checking our modules." (P2)

The teacher gave their instructional support by giving students time to study before taking an assessment, and giving students remedial if the students get low scores on exams. Sometimes, the teacher sends practice problem solving after a lecture or after class and activity sheets which include the summary of the lesson, formula, concepts, and problem-solving.

"As long as we are given a time to study." (P3)

"Sometimes, our teacher is providing a remedial if our scores in exam are low." (P2)

"Our teacher is sending us practice problem solving." (P16)

"Because our teachers are sending us learning activity sheets." (P18)

Resources Provided were Helpful

The Grade 12 STEM students describe the instructional support given to them as helpful based on their experience in a blended learning modality. Textbooks, modules, and worksheets are aids in learning physics because those printed materials include examples of solving problems and concepts which students can read anytime in their homes. Sometimes links to educational videos on YouTube helped students to understand difficult concepts and complex problem-solving.

"Textbooks and worksheets. It makes learning process easier because of the examples given from textbooks and modules." (P2)

"The links sent by our teachers from Youtube was very helpful." (P5)

"It was very helpful. Even though we are not in face-to-face classes, at least we have modules to read in our own homes and we are able answer it." (P16)

Difficulty in Studying using only Online Resources

The students who took Physics class described their instructional support given to them as difficult. Students cannot learn with just a video because the way of teaching and lecturing are different; it will cause students to confused. Sometimes students felt it hard to understand the lesson because hard and soft copy of modules are not enough for students to learn.

"Very difficult because the modular and the soft copy of modules during online class was insufficient." (P1)

"I cannot learn through video. YouTube contains different ways of teaching." (P12)

The difficulties and coping mechanism employed by students in learning physics.

The STEM students in Libertad National High School encountered many difficulties in learning physics. Although they were given some instructional support by their teacher, they still find difficulties in learning in some areas in physics subject.

Difficulty in Understanding Concepts

Participants perceived the concepts in physics as very hard to understand. Participants mentioned that they have difficulty in understanding concepts because some topics are complex and theoretical. There are many concepts and formulas to memorize and understand that are required in order to grasp the different concepts in physics. Also, another factor is learning on their own especially during distance learning because not all the topics were taught during face-to-face class. As a result, they struggled to comprehend fundamental ideas in physics. Participants shared:

"There are some topics that are very difficult to understand." (P1)

"There are so many to memorized, therefore it should be understood or else we don't have answers. In formulas, it must be memorized." (P5)

"Sometimes, there are lessons that we cannot comprehend." (P6)

"Very difficult because it's difficult to memorize. It's very difficult to understand why these happened. Nabudlayan gid kay budlay

sauluhon, budlay intindihon kung nga a nag amo na siya.” (P13)

“The difficulties is I find it difficult to understand because it is a self learning so it’s very difficult. Even I read it in the module, it’s difficult because no one is teaching me.” (P4)

Lack of Focus

Learning of physics requires a lot of focus and attention in order to improve academic performance in physics. However, participants mentioned that they have difficulty in studying Physics because they have lack of focus. Their focus and attention were not directly to the subject matter due to a reason that the subject is very hard to understand especially when they were in their distance learning. The participant shared:

“It’s difficult to focus.” (P3)

Difficulty in Answering Assessments

The assessments were given to the participants individually under the distance learning. The participants shared that they found assessments hard because the activities are not connected, as well as formulae are different from what is being thought and from the given examples during face-to-face. According to the participants, some questions in the given assessments are not discussed or taught by their teachers. The participants shared:

“It’s difficult and the answering of assessments. Then, our teachers are giving us extra activities to answer.” (P7)

“She is providing us an activity and example. Then, the given activity was not connected. As a result, we were confused with the given formula.” (P10)

“The answering of module because if its modular, the provided examples are different from the problem given.” (P12)

Difficulty in Problem Solving

One of the difficulties encountered of students in learning Physics is problem solving. Participants mentioned that they have difficulties in problem solving because of the long formula and complicated derivation of it. In solving the problems, participants encountered different terms and symbols that they are not familiar with. In response, they find it difficult to

apply the different formulas in physics. The participants shared:

“The solving parts especially in circuits.” (P19)

“I encountered difficult problem solving. It seems like there are techniques that I don’t know.” (P15)

“Physics is a very difficult subject because it’s all about solving. The laws are very difficult to learn.” (P16)

“In lessons, I find terms difficult because there are terms in Physics like for example the I symbolizes current. So, if I don’t know that, I cannot answer that I is a current.” (P11)

Moreover, they were confused on what formula will be used in answering the problem solving given to them because according to the participants, the suggested formulas are different depending on their sources such as internet, learning modules, and the answers of their classmates. However, they choose to follow what is being taught in the module. A participant shared:

“Then, when I asked my classmate, he got different answer because he has a different source. The module contents differ from internet. If the formula from the module is different from the internet, I prefer to refer on the module to play safe.” (P18)

On the other hand, there are problems that the students can also answer. The participant shared that:

“There are some parts that are I can do.” (P19)

Coping Mechanism

When dealing with a stressful situation or suffering difficulties, the term "coping" refers to the thoughts and activities that one resort to (Cliche, 2017). Learning styles, regulating negative emotions and seek support and assistance are the formulated theme under coping mechanism.

Learning Style

This refers to the participants' physics learning strategies. According to the responses, the majority of them prefer group study (face-to-face) in order to learn from one another. One participant said that one of his methods of learning physics is to stay up late at night and

put in extra hours so that they can keep up with the time and move on to the next topic. Another method is to follow the procedure as outlined in the module and to practice with the sample problems provided. The participants shared:

“Group study with friends.” (P3)

“For me, to pass my bedtime hours to reach our time and to make it on the next topic.” (P1)

“I follow the step by step solution of the problem written in the book.” (P12)

“I prefer group study, I can’t understand the concept if I have no company in studying.” (P11)

“Group study. I chat on GC to have a group study about incoming quiz, even exams. Face-to-face group study.” (P14)

“I always practice solving whenever the teacher will be giving a problem sets.” (P19)

Regulating Negative Emotions

Regulating negative emotions focuses on regulating negative emotional reactions to stress such as anxiety, fear, sadness, and anger. This type of coping may be useful when a stressor is something that individual cannot change. According to the participants’ responses, they usually do things like eat, sleep, and play to cope with the problems they have when learning physics. The participants shared:

“I sleep. Sometimes I cry.” (P7)

“I’m just playing Mobile Legends.” (P12)

“If there are some problems, I just eat.” (P17)

Seek Support and Assistance

Informational support refers to messages that include knowledge or facts, such as advice or feedback on actions (Ko, Wang & Xu, 2013). Support and assistance from experts are one of the participants’ coping mechanisms in learning physics, according to their responses. The participants mentioned that in order to cope with the problems they face in learning physics, they usually seek assistance from those they know can help them, such as their parents, friends, and teacher. They also look for materials online, such as Google and YouTube. The participants shared:

“If we have some difficulties and if we can’t understand the lesson, we ask help from our teacher, we chat to her asking how to derive

this kind of formula, how to solve the problem for us to better understand the lesson.” (P2)

“I seek for help with my parents and I watch YouTube about the topics that I can’t understand.” (P4)

“I go and ask to my teacher, and browse on the internet there’s something I do not understand.” (P17)

“I seek help from my classmates.” (P12)

“I cope with those difficulties, sometimes I ask to my cousins which are teachers and sometimes to my classmates if they have example of using of answering that problem-solving questions and me, self-taught, watching videos and reading textbooks” (P9)

The Figure above shows the framework made by the researchers that can be used as an Input for Enhanced Strategies in Learning Physics. The framework is composed of Senior High School STEM students’ experiences, Instructional support, difficulties, coping mechanisms and the proposed enhanced strategies in the blended learning mode which are Face-to-face learning, modular distance learning and online learning. The framework also shows the preparation of STEM students in blended learning mode such as: watching YouTube videos, browsing the internet, buying new phone, purchasing load, finding a conducive place for answering module, buying a notebook, paper and pens. The students’ mentioned that their learning styles are: Group Study, Watching Educational videos, Self-study, Asking help from teachers and classmates. Moreover, the framework also shows the instructional support offered by the teacher to the students, which include Textbooks, Learning Activity Sheets, Learning Modules, Educational videos, Remediation, monitoring via Messenger, Giving students time to study, and Giving time for students to practice problem solving.

This framework also shows the difficulties encountered by the STEM students in learning Physics in the Blended learning mode which include difficulty in Long formulas and Hard concepts, Incomplete information in module, insufficient sources, concepts and activities are not connected, difficult questions, complicated derivation of formulas, terms, and unfamiliar symbols that are not familiar. However, they have also included how they cope with this

difficulties like studying in groups, staying up late, practicing problem solving, playing online games, eating, sleeping, seeking help, watching educational videos on YouTube, and browsing the internet.

With these collected information, the researchers proposed enhance learning strategies which can become a basis for learning physics in the blended learning mode: Edutainment, Cross-question, 3P's (practice-practice-practice).

Insights and Implications

Insights

Participants in a study on learning physics said they struggle with concepts, formulas, and problem-solving methods. The participants' responses revealed that despite of the supports given to them they still struggle with physics. It is vital that the education sector continue to provide them with the resources they need to enable them to learn effectively. Every student should be taught how to become adaptive to the changes that occur around them, and this will help improve their learning of physics. Furthermore, it is not enough to simply observe students; it is always better to ask them what they necessitate and what things work well for them, because they are the ones who have encountered difficulties and are the ones who know what needs to be improved in instructional supports and strategies. Lastly, effective partnerships between schools and stakeholders will help students learn physics better.

Implications

The results of this study helps the researchers to achieve their goal which is to develop a learning framework to enhance the learning in physics in senior high school. First, the Science, Technology, Engineering and Mathematics (STEM) Senior High School students need to adapt the change of learning modality and find way how to cope with their different difficulties in learning Physics, and students need to enhance their learning process in physics in blended learning mode through using different learning styles; group study or self-study, watching educational videos, and by asking help from teachers and classmates. Second, the

teachers need to deliver their lessons well, to enhance their teaching styles, to be aware of their behavior in dealing with students having difficulties in learning physics, and need to select the appropriate learning materials for teaching physics in blended learning mode. Third, school heads need to implement programs to monitor the social-emotional well being of students enrolled in blended learning class, as some students may isolate themselves from social interactions. Lastly, the researchers recommend to the future researchers to have more follow-up questions to get the participant's insights and to answer the SOPs precisely.

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